```
import pandas as pd
import numpy as np
df=pd.read_csv('/kaggle/input/phishing-website-detector/phishing.csv')
df
```

```
       Index  UsingIP  LongURL  ShortURL  Symbol@  Redirecting//  \
0          0        1        1         1        1              1
1          1        1        0         1        1              1
2          2        1        0         1        1              1
3          3        1        0        -1        1              1
4          4       -1        0        -1        1             -1
...      ...      ...      ...       ...      ...            ...
11049  11049        1       -1         1       -1              1
11050  11050       -1        1         1       -1             -1
11051  11051        1       -1         1        1              1
11052  11052       -1       -1         1        1              1
11053  11053       -1       -1         1        1              1

       PrefixSuffix-  SubDomains  HTTPS  DomainRegLen  ...
UsingPopupWindow  \
0                 -1           0      1            -1  ...
1
1                 -1          -1     -1            -1  ...
1
2                 -1          -1     -1             1  ...
1
3                 -1           1      1            -1  ...
-1
4                 -1           1      1            -1  ...
1
...              ...         ...    ...           ...  ...
...
11049              1           1      1            -1  ...
-1
11050             -1           1     -1            -1  ...
-1
11051             -1           1     -1            -1  ...
1
11052             -1          -1     -1             1  ...
-1
11053             -1          -1     -1             1  ...
1

       IframeRedirection  AgeofDomain  DNSRecording  WebsiteTraffic
PageRank  \
0                      1           -1            -1               0
-1
1                      1            1            -1               1
-1
2                      1           -1            -1               1
```

```
-1
3                      1             -1            -1               0
-1
4                      1              1             1               1
-1
...                  ...            ...           ...             ...
...
11049                 -1              1             1              -1
-1
11050                  1              1             1               1
1
11051                  1              1             1               1
-1
11052                  1              1             1               1
-1
11053                  1             -1             1              -1
-1

       GoogleIndex  LinksPointingToPage  StatsReport  class
0                1                    1            1     -1
1                1                    0           -1     -1
2                1                   -1            1     -1
3                1                    1            1      1
4                1                   -1           -1      1
...            ...                  ...          ...    ...
11049            1                    1            1      1
11050            1                   -1            1     -1
11051            1                    0            1     -1
11052            1                    1            1     -1
11053           -1                    1           -1     -1

[11054 rows x 32 columns]
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 11054 entries, 0 to 11053
Data columns (total 32 columns):
 #   Column               Non-Null Count  Dtype
---  ------               --------------  -----
 0   Index                11054 non-null  int64
 1   UsingIP              11054 non-null  int64
 2   LongURL              11054 non-null  int64
 3   ShortURL             11054 non-null  int64
 4   Symbol@              11054 non-null  int64
 5   Redirecting//        11054 non-null  int64
 6   PrefixSuffix-        11054 non-null  int64
 7   SubDomains           11054 non-null  int64
 8   HTTPS                11054 non-null  int64
 9   DomainRegLen         11054 non-null  int64
 10  Favicon              11054 non-null  int64
 11  NonStdPort           11054 non-null  int64
 12  HTTPSDomainURL       11054 non-null  int64
 13  RequestURL           11054 non-null  int64
 14  AnchorURL            11054 non-null  int64
 15  LinksInScriptTags    11054 non-null  int64
 16  ServerFormHandler    11054 non-null  int64
 17  InfoEmail            11054 non-null  int64
 18  AbnormalURL          11054 non-null  int64
 19  WebsiteForwarding    11054 non-null  int64
 20  StatusBarCust        11054 non-null  int64
 21  DisableRightClick    11054 non-null  int64
 22  UsingPopupWindow     11054 non-null  int64
 23  IframeRedirection    11054 non-null  int64
 24  AgeofDomain          11054 non-null  int64
 25  DNSRecording         11054 non-null  int64
 26  WebsiteTraffic       11054 non-null  int64
 27  PageRank             11054 non-null  int64
 28  GoogleIndex          11054 non-null  int64
 29  LinksPointingToPage  11054 non-null  int64
 30  StatsReport          11054 non-null  int64
 31  class                11054 non-null  int64
dtypes: int64(32)
memory usage: 2.7 MB

df.describe()

              Index       UsingIP       LongURL      ShortURL
Symbol@  \
count  11054.000000  11054.000000  11054.000000  11054.000000
11054.000000
mean    5526.500000      0.313914     -0.633345      0.738737
0.700561
std     3191.159272      0.949495      0.765973      0.674024
0.713625
min        0.000000     -1.000000     -1.000000     -1.000000     -
1.000000
25%     2763.250000     -1.000000     -1.000000      1.000000
1.000000
50%     5526.500000      1.000000     -1.000000      1.000000
1.000000
75%     8289.750000      1.000000     -1.000000      1.000000
1.000000
max    11053.000000      1.000000      1.000000      1.000000
1.000000

       Redirecting//  PrefixSuffix-    SubDomains         HTTPS
DomainRegLen  \
count   11054.000000   11054.000000  11054.000000  11054.000000
11054.000000
```

```
mean        0.741632      -0.734938      0.064049      0.251040     -
0.336711
std         0.670837       0.678165      0.817492      0.911856
0.941651
min        -1.000000      -1.000000     -1.000000     -1.000000     -
1.000000
25%         1.000000      -1.000000     -1.000000     -1.000000     -
1.000000
50%         1.000000      -1.000000      0.000000      1.000000     -
1.000000
75%         1.000000      -1.000000      1.000000      1.000000
1.000000
max         1.000000       1.000000      1.000000      1.000000
1.000000

       ...  UsingPopupWindow  IframeRedirection   AgeofDomain
DNSRecording  \
count  ...      11054.000000       11054.000000  11054.000000
11054.000000
mean   ...          0.613353           0.816899      0.061335
0.377239
std    ...          0.789845           0.576807      0.998162
0.926158
min    ...         -1.000000          -1.000000     -1.000000     -
1.000000
25%    ...          1.000000           1.000000     -1.000000     -
1.000000
50%    ...          1.000000           1.000000      1.000000
1.000000
75%    ...          1.000000           1.000000      1.000000
1.000000
max    ...          1.000000           1.000000      1.000000
1.000000

       WebsiteTraffic      PageRank   GoogleIndex  LinksPointingToPage
\
count    11054.000000  11054.000000  11054.000000         11054.000000

mean         0.287407     -0.483626      0.721549             0.343948

std          0.827680      0.875314      0.692395             0.569936

min         -1.000000     -1.000000     -1.000000            -1.000000

25%          0.000000     -1.000000      1.000000             0.000000

50%          1.000000     -1.000000      1.000000             0.000000

75%          1.000000      1.000000      1.000000             1.000000
```

```
max          1.000000      1.000000      1.000000             1.000000


        StatsReport         class
count  11054.000000  11054.000000
mean       0.719739      0.113986
std        0.694276      0.993527
min       -1.000000     -1.000000
25%        1.000000     -1.000000
50%        1.000000      1.000000
75%        1.000000      1.000000
max        1.000000      1.000000

[8 rows x 32 columns]
```

```
df.isnull().sum()
```

```
Index                  0
UsingIP                0
LongURL                0
ShortURL               0
Symbol@                0
Redirecting//          0
PrefixSuffix-          0
SubDomains             0
HTTPS                  0
DomainRegLen           0
Favicon                0
NonStdPort             0
HTTPSDomainURL         0
RequestURL             0
AnchorURL              0
LinksInScriptTags      0
ServerFormHandler      0
InfoEmail              0
AbnormalURL            0
WebsiteForwarding      0
StatusBarCust          0
DisableRightClick      0
UsingPopupWindow       0
IframeRedirection      0
AgeofDomain            0
DNSRecording           0
WebsiteTraffic         0
PageRank               0
GoogleIndex            0
LinksPointingToPage    0
StatsReport            0
class                  0
dtype: int64
```

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 11054 entries, 0 to 11053
Data columns (total 32 columns):
 #   Column               Non-Null Count  Dtype
---  ------               --------------  -----
 0   Index                11054 non-null  int64
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 4   Symbol@              11054 non-null  int64
 5   Redirecting//        11054 non-null  int64
 6   PrefixSuffix-        11054 non-null  int64
 7   SubDomains           11054 non-null  int64
 8   HTTPS                11054 non-null  int64
 9   DomainRegLen         11054 non-null  int64
 10  Favicon              11054 non-null  int64
 11  NonStdPort           11054 non-null  int64
 12  HTTPSDomainURL       11054 non-null  int64
 13  RequestURL           11054 non-null  int64
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 18  AbnormalURL          11054 non-null  int64
 19  WebsiteForwarding    11054 non-null  int64
 20  StatusBarCust        11054 non-null  int64
 21  DisableRightClick    11054 non-null  int64
 22  UsingPopupWindow     11054 non-null  int64
 23  IframeRedirection    11054 non-null  int64
 24  AgeofDomain          11054 non-null  int64
 25  DNSRecording         11054 non-null  int64
 26  WebsiteTraffic       11054 non-null  int64
 27  PageRank             11054 non-null  int64
 28  GoogleIndex          11054 non-null  int64
 29  LinksPointingToPage  11054 non-null  int64
 30  StatsReport          11054 non-null  int64
 31  class                11054 non-null  int64
dtypes: int64(32)
memory usage: 2.7 MB
```

```
df.isnull().sum()
```

```
Index                  0
UsingIP                0
LongURL                0
ShortURL               0
Symbol@                0
Redirecting//          0
```

```
PrefixSuffix-           0
SubDomains              0
HTTPS                   0
DomainRegLen            0
Favicon                 0
NonStdPort              0
HTTPSDomainURL          0
RequestURL              0
AnchorURL               0
LinksInScriptTags       0
ServerFormHandler       0
InfoEmail               0
AbnormalURL             0
WebsiteForwarding       0
StatusBarCust           0
DisableRightClick       0
UsingPopupWindow        0
IframeRedirection       0
AgeofDomain             0
DNSRecording            0
WebsiteTraffic          0
PageRank                0
GoogleIndex             0
LinksPointingToPage     0
StatsReport             0
class                   0
dtype: int64
```

```python
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier,
ExtraTreesClassifier
from sklearn.linear_model import LogisticRegression
from sklearn.svm import SVC
from sklearn.metrics import accuracy_score

# Load your dataset
# Assuming your dataset is in a CSV file named 'students_data.csv'

# Assuming 'Target' is the target variable
X = df.drop('class', axis=1)
y = df['class']

# Split the dataset into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y,
test_size=0.2, random_state=42)

# Random Forest Classifier
rf_classifier = RandomForestClassifier(random_state=42)
rf_classifier.fit(X_train, y_train)
```

```python
rf_predictions = rf_classifier.predict(X_test)
rf_accuracy = accuracy_score(y_test, rf_predictions)
print("Random Forest Accuracy:", rf_accuracy)

# Logistic Regression
lr_classifier = LogisticRegression(random_state=42, max_iter=1000)
lr_classifier.fit(X_train, y_train)
lr_predictions = lr_classifier.predict(X_test)
lr_accuracy = accuracy_score(y_test, lr_predictions)
print("Logistic Regression Accuracy:", lr_accuracy)

# Extra Trees Classifier
et_classifier = ExtraTreesClassifier(random_state=42)
et_classifier.fit(X_train, y_train)
et_predictions = et_classifier.predict(X_test)
et_accuracy = accuracy_score(y_test, et_predictions)
print("Extra Trees Accuracy:", et_accuracy)


# SVM Classifier
svm_classifier = SVC(random_state=42)
svm_classifier.fit(X_train, y_train)
svm_predictions = svm_classifier.predict(X_test)
svm_accuracy = accuracy_score(y_test, svm_predictions)
print("SVM Accuracy:", svm_accuracy)
```

```
Random Forest Accuracy: 0.9696969696969697
Logistic Regression Accuracy: 0.9335142469470827
Extra Trees Accuracy: 0.9687924016282226
SVM Accuracy: 0.5585707824513795
```

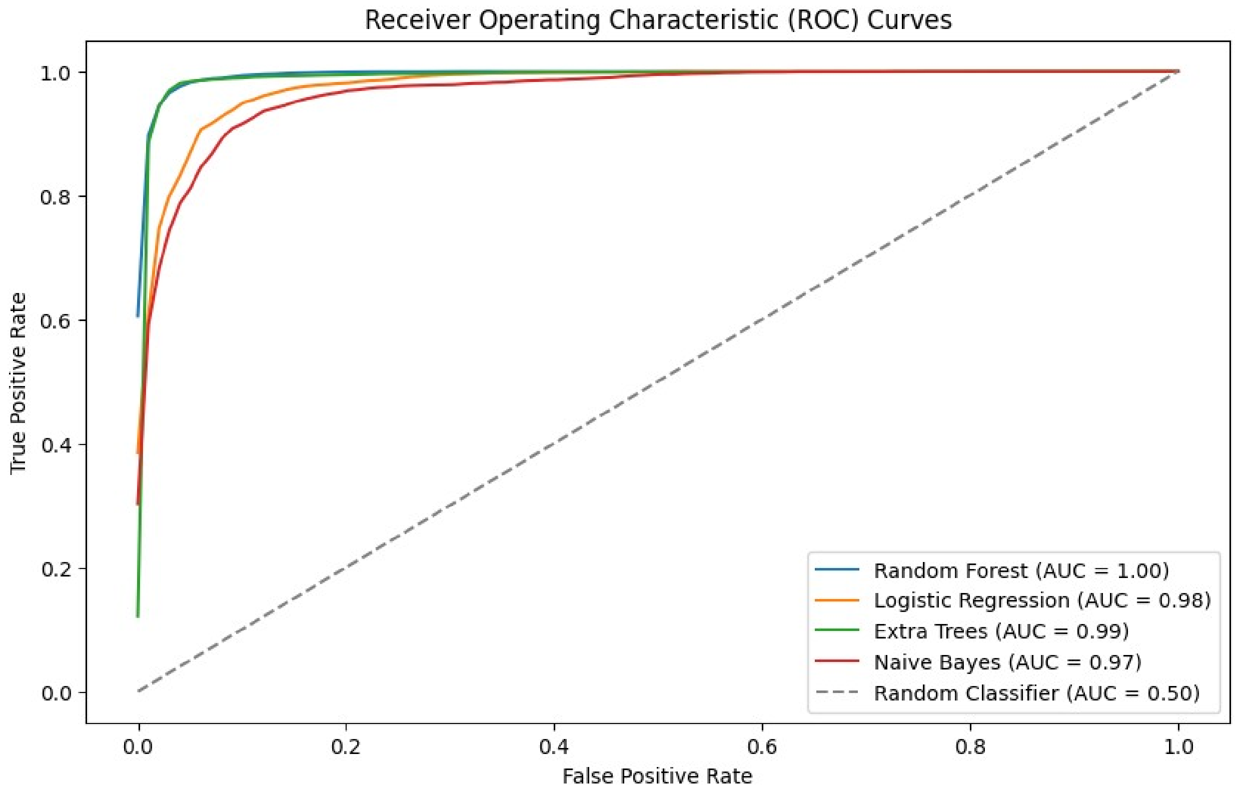
```python
import pandas as pd
from sklearn.model_selection import StratifiedKFold
from sklearn.ensemble import RandomForestClassifier,
ExtraTreesClassifier
from sklearn.linear_model import LogisticRegression
from sklearn.naive_bayes import GaussianNB
from sklearn.metrics import accuracy_score, classification_report

# Load your dataset
# Assuming your dataset is in a CSV file named 'students_data.cs

# Define the classifiers
classifiers = {
    'Random Forest': RandomForestClassifier(),
    'Logistic Regression': LogisticRegression(max_iter=1000),
    'Extra Trees': ExtraTreesClassifier(),
    'Naive Bayes': GaussianNB()
}
```

```
# Set up k-fold stratified cross-validation
k_folds = 5  # You can adjust the number of folds
skf = StratifiedKFold(n_splits=k_folds, shuffle=True, random_state=42)

# Train and evaluate each classifier
for clf_name, clf in classifiers.items():
    print(f"Classifier: {clf_name}")
    accuracy_list = []
    classification_reports = []

    for train_index, test_index in skf.split(X, y):
        X_train, X_test = X.iloc[train_index], X.iloc[test_index]
        y_train, y_test = y.iloc[train_index], y.iloc[test_index]

        clf.fit(X_train, y_train)
        y_pred = clf.predict(X_test)

        accuracy = accuracy_score(y_test, y_pred)
        accuracy_list.append(accuracy)

        classification_reports.append(classification_report(y_test,
y_pred))

    # Display average accuracy and classification report
    avg_accuracy = sum(accuracy_list) / k_folds
    print(f"Average Accuracy: {avg_accuracy:.6f}")

    print("Average Classification Report:")
    for metric in classification_reports[0].split('\n')[:-1]:
        print(metric)
    print("\n" + "="*50 + "\n")
```

```
Classifier: Random Forest
Average Accuracy: 0.968518
Average Classification Report:
              precision    recall  f1-score   support

          -1       0.97      0.96      0.97       980
           1       0.97      0.98      0.97      1231

    accuracy                           0.97      2211
   macro avg       0.97      0.97      0.97      2211
weighted avg       0.97      0.97      0.97      2211

==================================================

Classifier: Logistic Regression
Average Accuracy: 0.925728
Average Classification Report:
              precision    recall  f1-score   support
          -1       0.94      0.88      0.91       980
           1       0.91      0.95      0.93      1231

    accuracy                           0.92      2211
   macro avg       0.92      0.92      0.92      2211
weighted avg       0.92      0.92      0.92      2211

==================================================

Classifier: Extra Trees
Average Accuracy: 0.970690
Average Classification Report:
              precision    recall  f1-score   support

          -1       0.97      0.96      0.97       980
           1       0.97      0.98      0.97      1231

    accuracy                           0.97      2211
   macro avg       0.97      0.97      0.97      2211
weighted avg       0.97      0.97      0.97      2211

==================================================

Classifier: Naive Bayes
Average Accuracy: 0.885200
Average Classification Report:
              precision    recall  f1-score   support

          -1       0.84      0.93      0.88       980
           1       0.94      0.86      0.89      1231

    accuracy                           0.89      2211
   macro avg       0.89      0.89      0.89      2211
weighted avg       0.89      0.89      0.89      2211

==================================================
```

```python
from sklearn.metrics import roc_curve, auc
import matplotlib.pyplot as plt

# Specify the classifiers
classifiers = {
    'Random Forest': RandomForestClassifier(),
    'Logistic Regression': LogisticRegression(max_iter=1000),
    'Extra Trees': ExtraTreesClassifier(),
    'Naive Bayes': GaussianNB()  # Note: SVM needs probability
estimates for ROC curve
}

# Number of folds for stratified k-fold
```

```
num_folds = 5

# Initialize a plot for ROC curves
plt.figure(figsize=(10, 6))

# Perform stratified k-fold validation
kf = StratifiedKFold(n_splits=num_folds, shuffle=True,
random_state=42)

for clf_name, clf in classifiers.items():
    mean_fpr = np.linspace(0, 1, 100)
    tpr_sum = 0
    auc_sum = 0

    for train_index, test_index in kf.split(X, y):
        X_train, X_test = X.iloc[train_index], X.iloc[test_index]
        y_train, y_test = y.iloc[train_index], y.iloc[test_index]

        # Fit the model
        clf.fit(X_train, y_train)

        # Get predicted probabilities for positive class
        y_probs = clf.predict_proba(X_test)[:, 1]

        # Calculate ROC curve
        fpr, tpr, _ = roc_curve(y_test, y_probs)
        tpr_sum += np.interp(mean_fpr, fpr, tpr)
        auc_sum += auc(fpr, tpr)

    # Average ROC curve over all folds
    mean_tpr = tpr_sum / num_folds
    mean_auc = auc_sum / num_folds

    # Plot the ROC curve
    plt.plot(mean_fpr, mean_tpr, label=f'{clf_name} (AUC =
{mean_auc:.2f})')

# Plot the random classifier (baseline)
plt.plot([0, 1], [0, 1], linestyle='--', color='grey', label='Random
Classifier (AUC = 0.50)')

# Customize the plot
plt.title('Receiver Operating Characteristic (ROC) Curves')
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.legend()
plt.show()
```


Receiver Operating Characteristic (ROC) Curves
True Positive Rate
False Positive Rate
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.2
0.4
0.6
0.8
1.0
Random Forest (AUC = 1.00)
Logistic Regression (AUC = 0.98)
Extra Trees (AUC = 0.99)
Naive Bayes (AUC = 0.97)
Random Classifier (AUC = 0.50)